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ABSTRACT

Various aspects of the Optical Mark Reader (OMR) used by the Atlanta Public School System are discussed. First considered are the required features of the OMR scanner. Following this, methods of motivating users to record data accurately are described. Finally, a description of how forms are designed for the convenience of users is provided. (PB)

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TRENDS IN OMR TECHNIQUES AND EQUIPMENT

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The Atlanta Public School System has for many years been involved in the search for a better means of collecting data. This data gathering chore is necessary to support a rather large community of computer Users and a wide variety of computer applications.

After much searching and experimentation, the system has evolved into a very efficient and inexpensive data gathering implementation. An Optical Mark Reader (OMR) was installed in October of 1970 and has been used regularly since that time. A second machine was installed in the Fall of 1972.

One of the reasons for the installation of OMR hardware is the need for a high degree of flexibility. Examples of required features of the OMR scanner are:

1) The scanner should read both sides of the document at the same time.
2) The physical dimensions of the form should be a function of the data entry applications rather than a set standard size.
3) Each form should be validated at read time by the scanner for quality of information read.
4) Each form should be checked at read time for extraneous information which might be picked up from the ink or stray marks on the form.
5) Each photo-electric read cell should be checked to ensure that all cells are functioning properly on each form scanned.
6) The machine should be programmable.
7) The machine should have variable read speed for processing documents.
8) Since the hardware should be programmable, each scan form should have the capability of being uniquely identified and recognizable to the software system. This facility would allow for several different forms to be read in one run on the scanner and still maintain integrity of the data processed. An example of this is the capability of processing multiple test response forms for different tests and each uniquely scored with the appropriate, and correct responses.

OBIE WARD has been instrumental in the development of the Atlanta Public School System Computer Center since its conception in 1962. He shares the responsibility for the creation and maintenance of the constantly increasing number of OMR (Optical Mark Reader) applications which are operational in Atlanta.

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Our applications for using the OMR approach are as varied as the systems that we have implemented. As of this date, we have never had a failure for a particular application and once the scanner approach has been implemented, we have not had to eliminate the scanner form as the vehicle for data entry.

I am frequently asked, "How do you get people to mark the form?" Perhaps our philosophy is different from other organizations but we have several premises that we operate on. They are:

1) The data to be collected has to originate somewhere. This is a patently obvious assumption but one which, surprisingly, is not apparent to some users.
2) If (1) is valid, then why not require the recording of data in such a way as to have it entered only once, by the user. This again is a rather obvious conclusion but one that escapes some people.
3) If by now you are convinced that (1) and (2) are valid assumptions, and I think that they are, consider for a moment who is recording the data. The User recording the data is seeking assistance. It is apparent that he has a need and this transaction is going to satisfy the need if this User correctly performs his task of data entry. The User could be a student taking a test, a teacher requesting a film, a librarian buying a book or an accounting clerk trying to pay an invoice. They all have one thing in common; they wish to communicate certain information to the computer.
4) By now, it is apparent that the User has the incentive to record the data accurately, correctly and in the proper form. He is aware of the necessity of the integrity of the scan form and to thus make a valid transaction for the computer.

Our Users look on this approach to data gathering as a simple and efficient way for them to communicate with the computer. There is nothing degrading about marking a bubble on a scanner form. Quite the contrary, the User is assured by hardware and software reliability that he is going to get exactly what he requested on the scanner form. Since the User is the only human involved and assuming that he has accomplished his task of entering the information on the scan forms correctly and accurately he is assured of this becoming a legitimate transaction for the computer. As I mentioned, this transaction could conceivably be a test document from a first grade student or it could be payroll information from the maintenance department. The scanner could really care less.

A great many of our applications by design, use turn-around documents. This imposes a constraint on us that demands that this document be processed over night and be returned to the User the next morning. This particular facet of our data collection system is what makes it function in a pseudo on-line mode.

Since the User is communicating directly with the computer, via the scanner, it certainly behooves us in the computer center to see to it that the scanner form is designed with the User in mind. There are several ways to assist the User in this regard:

1) Keep the form simple. Never create a "busy" form. Brevity is never any more in vogue than it will be on a scan form.
2) Require as little marking as possible from the User. This constraint makes for a happy and satisfied User and if they have to make a minimum of marks you have reduced the possibility of error simply by forms design. Some examples of what I have in mind are: let one bubble represent the month of the year, one bubble represent the day of the month and one bubble represent the units position of the year. As you can see, you have now recorded the date with three bubbles rather than six. We have numerous examples of this approach to data coding in our system.
3) If at all possible, make the form a "turn-around" document. There are numerous applications that can originate at the computer center. A pre-printed form with the information coming from our central file system is going to be accurate and the recording is going to be done correctly. Examples of these applications are student related forms activity. This form of data entry reduces errors to a minimum and at the same time requires that the data maintained in these central files be up-to-date at all times. Again the User, in this case the school, wants the data to be correct and he has an incentive to see to it that it is current.
4) Another assist that can be given the User is the "pre-printing" or "slugging" of repetitive information. By using the computer for this function, you win points with the User since less effort is required on his part in data entry. Additionally, you have assured the User that this much data has been entered correctly and the burden becomes his to also enter data correctly and accurately.

These general guidelines, we feel, are the necessary ingredients that keep our system functioning as efficiently as it does. Certainly we have to keep re-evaluating our approach and no form is ever considered to be a final evolution. We definitely feel that forms design is the heart of any scanner input system and therefore we are committed 100% to ensure that our Users have the best possible forms on which to enter their transactions.

In this time when so much emphasis is put on teleprocessing as the wave of the future, there is a great deal of pressure from vendors and users to implement this approach as a means of data-collection. The principal reason given, in addition to its futuristic appeal, is that the user is "on-line" to the computer, in a one-to-one conversational mode with the supreme being. In our opinion this is an expensive means of creating intimacy between the user and computer. The hardware cost is tremendous and the user education required is much more extensive and costly. Additionally, we feel that the scanner effectively puts the user "on-line" in that he is responsible for the input, he receives 24-hour turn-around with a hard-copy report and, most importantly, can process large amounts of data efficiently, quickly and at a minimum cost per character.